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AUTHOR Miller, George E.; Harless, William G.
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ABSTRACT

How has continuing medical education fared under instructional technology? For this reappraisal, the authors review the use of tapes, slides and film, in the medical profession in the U.S. and in the British Isles; radio and telephone, television, programed instruction, and computers (in their three-fold functions as retrievers of information, consultant in the diagnostic process, and instrument of instruction). Medical educators, the authors conclude, have embraced instructional technology with enormous enthusiasm, but have not done it systematically, seeming to have replaced their customary spirit of inquiry with a spirit of faith. They have neglected the process of diagnosing their needs, following it up with a specific prescription to correct the diagnosed defect, and a careful observation to determine whether the intervention has been effective. (Author/GO)

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INSTRUCTIONAL TECHNOLOGY AND CONTINUING MEDICAL EDUCATION

George E. Miller, and William G. Harless,
with the assistance of Hing-Kay Ho, *

Introduction

The explosive growth of medical knowledge that has accompanied a rapidly expanding investment in biomedical research over the last quarter century, has produced mounting anxiety among medical educators that the medical practitioner's half-life of professional competence is steadily shortening. To sustain the currency of that competence medical schools and professional associations, as well as voluntary and public health agencies, have addressed increasing attention to programs of continuing education, but growing discouragement about the efficacy of conventional modes of instruction has stimulated a search of methods that will heighten the interest and attention of practitioners and achieve educational goals more effectively than past efforts have seemed to do. In this spirit they have turned to educational and communications technology.

The initial portion of this report will be descrip-

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* George E. Miller is director of the Office of Research in Medical Education, Center for the Study of Medical Education at the University of Illinois. William G. Harless is chief of the Instructional Systems Section, Office of Research. Mrs. Hing-Kay Ho was an associate in the Instructional Systems Section at the time the paper was written.

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tive in order to give some sense of the present and contemplated use of instructional technology in continuing medical education; the concluding segment will be devoted to issues which seem to have been overlooked in the headlong rush to get on with educational programming.

Tapes, Slides and Film

Since the major educational problem with which practitioners must deal is widely believed to be that of coping with a continuing flood of new information, most of the technical adaptations now employed attempt to provide more efficient means of delivering this information, or better methods for a harassed practitioner to retrieve from the vast store of knowledge which no man can any longer hope to master, or even to retain, the bits he needs, at the time and place he needs them. Printed words as they are recorded in books, journals, and more recently in succinct medical newspaper summary articles, are still the most widely used means of information dissemination. But many physicians prefer a summary lecture by an expert to the independent search

which reading requires. Some years ago the California Medical Association attempted to provide such a mechanism by making available to its membership tape recordings of lectures delivered at professional meetings. The Audio Digest Foundation, which emerged from this effort, now produces weekly tapes in cartridge form which physicians may play while driving or shaving or engaging in other activities which do not require their full attention. This has proved sufficiently popular to lead the American Medical Association to announce a comparable service to begin in January 1969.

The Royal College of General Practitioners of Great Britain has adopted a similar plan selecting individuals who are both acknowledged subject matter experts and skilled in verbal communication to summarize a topic in a fashion that focuses upon the more general items that will be useful to a practitioner, avoiding the intricacies of a subject that may be especially appealing to an investigator. It has not always been possible to accomplish this goal, but their requirement of a preliminary script, a rehearsal, and thoughtful

editing have made this a generally admirable collection.

The British have also added a visual element to the sound, using slides to illustrate points that require something more than words. By adhering to a rule of simplicity such that the tape will fit any standard recorder, and the 35 mm slides any standard projector, they have made it possible for practitioners in all parts of the British Commonwealth to utilize the materials. At the present time the sound recording service loans approximately 1000 tapes each month.

In America the joining of sound and visuals has more often been automated than manual. The pharmaceutical industry which provides a large amount of continuing education, (commonly product rather than problem oriented) has supplied many detail men with portable solid state tape recorders and synchronized slide projectors that can be quickly assembled to deliver an illustrated lecture in a physicians office. This method is now being developed under other auspices to make brief and attractive summary presentations of current information available to physicians in places where they

congregate, for example in the doctors lounge of a hospital. Utilizing a device that captures in a single cartridge both visual and sound, the Metropolitan Washington Regional Medical Program is preparing a series of illustrated lectures on the identification of ovarian milignancy to be placed in surgical dressing rooms for surgeons to view between operations.

Perhaps the most complex of the synchronized mechanisms is the "medical juke-box" developed in the Albany Regional Medical Program. An adaptation of a standard machine it will contain 160 five minute LP recordings with synchronized visuals displayed from a self contained carousel projector. It will not only provide access to current summary information on a variety of topics, but also the means for a physician to record any unanswered questions. Periodic pickup of the question tape will lead to individual answers through the mails.

But audiotape has been used to do more than communicate information alone. The Royal College of General Practitioners has included in its collection an additional set of sounds whose recognition may facilitate

medical diagnosis and treatment, for example the whoop (of whooping cough), the flight of ideas which characterize the schizophrenic state, the non-verbal communication of anxiety or depression which inflections and intonations convey, or the feelings about hospitalization and illness which patients rarely reveal directly to their physicians. The sounds heard through the stethoscope also lend themselves to recording. The American Heart Associaiton has prepared an annotated collection of heart sounds on long playing records; another set is available on tape through the National Library of Medicine. Although simple to use, the sound fidelity has rarely satisfied cardiologists. The special heart sound recording device developed by Butterworth has minimized this problem, although at a very high cost. But all of these methods may soon be displaced by a new heart sound simulator that faithfully generates any kind of heart murmur, of any intensity and duration, in any part of the cardiac cycle, in the course of any cardiac rhythm.

Instructional films have long been available to

those responsible for programs of continuing medical education but they have never achieved widespread popularity. There are probably many reasons, but two stand out: 1) most films seem to include more than most teachers want to show. and 2) the technical problems of making a projector work sometimes seem overwhelming. The development of small, portable, cartridge projection have provided an escape from the second problem; the limited amount of film that a cartridge can hold has stimulated new production methods that deal with the first.

Single concept films are increasingly popular both for conveying summary information, and for demonstrating specific professional skills. The National Audiovisual Medical Center has been a major force in this development and now has an extensive catalogue of titles available on loan. The Washington-Alaska Regional Medical Program has utilized this method of reaching practitioners in remote areas. The University of Southern California is preparing a set of films for circulation to those in more urban settings; Wisconsin and Albany are planning the installations of projectors and film

cartridges in community hospitals as information sources. It is clear that these devices will be easier to use than more conventional films. Whether they will produce the desired learning remains to be seen.

Radio and Telephone

Whatever the technical and content excellence of audiotapes, either with or without visual supplementation, when used as self-contained instructional devices they fail to incorporate what is generally regarded as an integral element of optimal instruction: direct teacher-learner interaction. The two way FM radio network established more than a decade ago at the Albany Medical College was designed to achieve this exchange in the course of bringing to physicians in their community hospitals the most recent information which a medical faculty could provide. The original network included six hospitals within a 50 mile radius of the College FM transmitter; with a new transmitter recently installed on New England's highest mountain, and with land line connection to other commercial FM transmitters in the region, the network now includes some seventy

hospitals. The program format includes an initial 15-30 minute presentation by a panel of experts; the remainder of the broadcast hour is devoted to questions from audiences in participating hospitals. No more than fourteen hospitals are included in any single day so that staff in each institution may have an opportunity for active engagement. By repeating the program each weekday, all seventy are included in the course of a week. On each occasion the initial presentation is broadcast from tape; the interaction is live. In order to incorporate visual material, slides and printed handouts for use in the course of the broadcast are prepared in advance and circulated to the participating institutions. The Albany model has now been transplanted to other parts of the country and interlinkages between distant networks make it possible to utilize an even larger faculty resource than a single institution could provide.

The use of telephone lines for comparable two way teaching conferences has not been widely adopted, but the telephone has been used for other kinds of continuing medical education. One of the simplest is as a

means for consultation on specific medical problems. While the telephone has long been employed for such communication between an individual physician and a personal consultant, only recently have several Regional Medical Programs attempted to facilitate this process by providing a cadre of experts on specific topics to whom access can be provided at any time.

A more imaginative development, most extensively used at the University of Wisconsin but being adopted in many other parts of the nation, is the provision of a library of 5-6 minute tape recorded summaries of current information on a variety of topics, to which any physician may have immediate access, twenty-four hours a day, by dialing the Department of Continuing Medical Education. The system is currently receiving nearly 20 calls/day from physicians, and another system has recently been established for nurses. Plans are now under way to expand the program to include tapes specifically designed to meet preceived information needs of other health professions.

Television

It is television, however, that appears to have

aroused the greatest interest among those struggling to adapt contemporary communications technology to the needs of continuing medical education. A pharmaceutical firm was among the first to exploit the medium, through closed circuit transmission of surgical operations from a hospital amphitheatre to medical convention viewing rooms where throngs were captivated by the technical excellence, and the dramatic quality, of a live production. From such a beginning, designed to serve the objective of demonstrating to many what had previously been demonstrable to only a few, development of the medium has proceeded. But only in South Carolina, where a statewide network joining public schools was made available for medical use during scheduled evening hours, has the closed circuit method been widely employed for other than intramural programming. The cost of such systems has led to increasing utilization of commercial and educational channels, but a battle still rages over whether the instruction designed for physicians is suitable for public viewing. A variety of devices have been introduced to assure the privacy of such instruction: at

UCLA the broadcast is scrambled so that it may be received only by sets with a decoding device; in Utah and Western Ontario the programs are announced only through personal mailing to the physician audience; in Oregon and Boston the broadcast occurs only after a ten minute break at the end of a regularly scheduled broadcast day. But neither in those instances where members of the general audience have inadvertently come upon medical programs, or in setting such as New York where programs were offered in prime time, has there been any public outcry about the nature or content of the programming.

While these productions have largely taken the form of one way communication, utilizing lecture and panel discussion and demonstration format (usually live but with increasing frequency from videotape), the opportunity for live exchange between experts and audience has been added in Pittsburgh and UCLA, using regular telephone channels for submission of questions during the broadcast period.

Since this medium has been regarded as one means of

reaching large numbers of practitioners at a time and place more convenient for them than the usual course offering it is interesting to note that the number of viewers has varied from 4.8% of the potential audience in the broadcast area of WNYC - TV in New York, to 19% in the area of WUED-TV in Salt Lake City.

The high cost in money and man hours of originating carefully planned topic programs with the regularity that continuing education requires has produced several efforts to lessen this burden upon individual educational groups. A pharmaceutical firm, for example, has established a videotape network, supporting production of tapes by individual medical groups, and providing for their exchange through the U.S. postal network. An Associaiton of Medical Television Broadcasters has worked out a similar exchange among members. In the former instance tapes are designed chiefly for local playback on portable tape recorders; in the latter, tapes are of broadcast quality. The UCLA group is now promoting a program of shared production as well as distribution resources, chiefly for the western Regional Medical Programs, but

with an open invitation to others who might wish to join in such a cooperative venture. The National Biomedical Communication Network now under development by the National Library of Medicine will provide even wider production and distribution capability.

Although broadcast television may seem to have received the widest attention in continuing medical education, other dimensions of the medium are also being explored. For example the Community Television Network in Atlanta utilizes the 2500 Megahertz Band width for bidirectional sharing of educational efforts among a limited group of local institutions. Thus a medical grand rounds in one institution, a clinical pathology conference in another, a guest lecture in a third may serve all. Bidirectional closed circuits for medical consultation (such as that recently demonstrated between Logan Airport and the Massachusetts General Hospital) are also being explored as continuing education devices. And finally exploitation of the immediate feedback potential of portable videotape recording is increasingly recognized as a useful aid to physicians who are

attempting to gain new professional skills or refine old ones.

Programmed Instruction

Medical educators were caught up in the tide of enthusiasm for programmed instruction and teaching machines which swept the entire educational community after Skinner's early publications. When a pharmaceutical firm reportedly received more than 50,000 requests for one of the linear programmed texts prepared under its sponsorship, there were many who voiced the hope that a solution had been found to the often frustrating problem of continuing medical education. As time has passed, enthusiasm has waned, for after an initial period of enchantment the linear programs become tiresone and even the more challenging branched forms rarely seem worth the effort required to flip back and forth through a scrambled book which can never be scanned, or used as a reference. And the machines which automated either linear or branched presentations seemed to offer no advantage, they merely required the learner to come to the machine rather than having instruction come to

him.

Programmed materials are still being produced in limited quantities and for special purposes, but the initial hopes of medical educators have been replaced by more realistic views about the potential of such devices. It is probably fair to note a growing acceptance of the view that the learning principles underlying programmed instruction, should be incorporated in all forms of instruction rather than captured only in specific pieces of hardware of software.

Computers

Among educational technologies that have attracted the interest of medical educators computers are currently the object of most intensive study and development. Although the technology is changing rapidly, it now appears that the computer will be able to play at least three roles in the continuing education of physicians: 1) for retrieval of information; 2) as a consultant in the diagnostic process; and 3) as an instrument of instruction.

The information retrieval functic is most vividly

demonstrated in the National Library of Medicine MEDLARS system in which the world medical literature is periodically catalogued and stored. A bibliographic search can be instituted upon request, but the current rate of requests (approximately 5,000 per/year) represents less than 2% of the potential biomedical community of scientists and practitioners. This may reflect the simple fact that a single inquiry almost inevitably unleashes a flood of titles. For the scientist total retrieval may be essential; for the practitioner, however, a more selective output, or production of appropriate abstracts rather than titles alone, may be required. In order to provide more discriminating output, or to produce an automated abstract of original documents, a considerable advance in computer handling of natural language will be required. Steps in the direction of facilitating the abstracting function have been taken both at the University of Oklahoma, where the method utilized was a variation of cluster analysis, and at the University of Rochester, where techniques of factorial analysis were employed, but each represents a very small step toward untimate

solution of the problem. The MEDLARS system is a superb beginning, and its extension to regional medical libraries has been useful to many scientists, but to be most successful as a mechanism for continuing education of practitioners it must probably become more selective and sophisticated in the kind of information it produces.

The consultative function is intended to provide practitioners with assistance in diagnosis or management of medical problems, or to provide some feedback about the nature or utility of their professional performance. At the University of Missouri, for example, the computer has been utilized to extract information patterns from a battery of laboratory tests to which each patient is subjected, in such a way that attention is focused upon elements that require further consideration, or which suggest with high probability a specific disease process. At the University of Utah a system that monitors a variety of physiological variables in the study of clinical cardiovascular problems has been particularly valuable in identifying congenital heart disease. At the Cleveland Metropolitan Hospital and the University of Wisconsin, computers

have been utilized to systematize the acquisition and analysis of historical information taken from individual patients, or the management of problems identified in the course of investigation. Although the basic purpose in each instance has been to facilitate and standardize data gathering, the educational effect of such a device upon practitioner performance of these tasks in other settings may be very significant.

The consultative function has been served in a more general way by two other systems. In the Professional Activities Survey-Medical Audit Program (PAS-MAP), hospital records are systematically abstracted at the local level, entered in a central computer an Ann Arbor, and analyzed periodically in a fashion that produces extensive feedback to practicipating institutions on the extent to which the staff is fulfilling basic data gathering and clinical management practices according to acknowledged professional standards. It is unfortunate that the vast collection of information which such monthly summary reports provide seems more often to end in an administrators file than in a staff meeting, but

this does not deny its importance as a potential, if not widely realized, adjunct to continuing medical education. A similar system, focused upon a single disease problem, is the computerized cancer registry which has been most fully developed at the University of Utah. The storage of standardized information about every cancer patient in the state from the time of diagnosis to cure or death, provides a mechanism for assembling data on the diagnostic and therapeutic effectiveness of indiviual practitioners or hospital staffs, who may then compare their performance with some absolute standard or relate it to that of comparable groups. Either method provides a useful entry to further education at the point where education is most likely to be effective: identified and acknowledged deficiencies.

As an instrument of instruction, in continuing medical education, the computer is only now being explored as a tutorial device, and as a simulator. The University of Oklahoma Medical Center has focused attention upon the tutorial mode and has gained some experience in its use both in locally offered course work and in a national

demonstration at an annual meeting of the American Medical Association. Physician acceptance of this unfamiliar tool was astonishingly positive, and preliminary studies revealed an encouraging level of learning associated with its use.

Simulations have been the focus of developmental work principally in two institutions. At the University of Southern California a life-like torso under computer control has been devised to respond in realistic fashion to administration of anesthetic agents, to the tracheal intubation that must often be carried out to assist respiration under anesthesia, and to develop the complications that may attend anesthesia (such as depressed respiration, vomiting, cardiac arrhythmias, for example) which must then be dealt with in the same manner that reality would require. At the University of Illinois a library of simulated clinical problems, now under development, will allow students at all levels to engage in independent problem solving, utilizing natural language to gather historical information from the computer, data about physical and

laboratory findings, and to intervene with independently generated management procedures that may resolve the problem successfully, induce complications that must then be dealt with, or lead to loss of the patient to another physician - or to the morgue. As instructional devices such simulations are exciting, and may under systematic study prove as effective as they now appear to be. But equally important may be their function in educational diagnosis - helping practitioners to identify personal deficiencies in clinical problem solving that may then be corrected using many instructional modes: Books, journals, films, courses or supervised experience. The automated system of simulated problem generation now under development will, if successful, allow almost limitless expansion of a problem library, and the establishment of a network such as that proposed by EDUCOM would provide wide access to such an instructional resource.

Exploitation of the computer as an instructional tool has only begun. Although an important start has been made there are still fundamental pedagogical pro-

blems to be explored, as well as technical problems such a as natural language input and analysis, modeling techniques and system design to be resolved. The question of educational effectiveness of computers is yet to be confirmed, but assuming this is answered affirmatively there remains an issue that can be overlooked during the developmental stage but which cannot indefinitely be ignored - that of cost.

Questions and Issues

Although this account has been illustrative rather than comprehensive, it must convey a sense of the eagerness with which instructional technology is being embraced by medical educators. But the dirth of systematic study, documentation of worth, analysis of cost-benefit, or exploration of alternatives is in striking contrast to the rigorous scrutiny to which diagnostic or therapeutic innovations are subjected before being incorporated into the medical armanentarium. It is almost as though the spirit of inquiry had been replaced by a spirit of faith, when these educators moved from laboratory or consulting room into the classroom.

The process of continuing education, like the process of medical management, should begin with a diagnosis of need, be followed by prescription of a specific intervention to correct the diagnosed defect, and observed with sufficient care to determine whether the intervention had been effective. The preoccupation with technology that characterizes so much of continuing education is like shotgun therapy, random fire in the hope that a target will be hit.

Even granting that the greatest need in continuing medical education is to bring to practitioners the most recent advances in medical science (a view that will be challenged by many thoughtful persons who would aver that physicians are already drowning in the flood of information that reaches them) the real issue is not that of signal transmission, but of signal response. There seems little question that the technologies noted earlier have an immense, often incredible, capacity to transmit, but there may be real question about whether they are being used to transmit what is needed, or the extent to which they produce a desired response. Unfortunately

very few of those responsible for continuing medical education appear to be trying to find out.

In reviewing the reports of technolgical innovations in continuing medical education one is led almost inevitably to the conclusion that in the minds of many writers the mere provision of an instructional method that reaches a substantial number of people who like what they receive is sufficient justification for its use. Virtually all reports of instructional innovation comment upon the number of listeners or viewers and their opinions about program worth, but almost none go beyond this superficial assessment of impact. Further in adopting such devices there appears to be widespread neglect of the principles of adult learning upon which there is general agreement among experts in the field, for example, the matter of active involvement in the learning rather than passive receipt of the learning which others have acquired, the facilitating effect of feedback, the emotional as well as the intellectual component of learning.

This is not to say that such elements cannot be incorporated in instructional technology-here and there

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they have been; but for the most part developers appear to behave as though the medium were indeed the message. And it may be - but not necessarily the desired one. The medical educator who is committed to television - or dial access or computers - will probably be no more successful than the physician who is committed to penicillin, whether the patient suffers from pneumonia, heart failure, or bunions.

In medicine there is clear need for further development of instructional technology that will involve all practitioners in active, self-directed and productive continuing education. But unless the developmental effort is accompanied by equally vigorous support of an educational research expertise among those who occupy leadership positions it may be found at the end of a decade that we have merely succeeded in creating more costly methods of doing the same old thing. For as one acute observer has put it, "We will never solve the problem (of information overload) by speed reading courses. What we need are courses that teach people to write things worth reading slowly."

And so it is with instructional technology where the need is for methods that produce a defined effect, not for tools that merely dazzle the beholder.